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Sedimentation regime and accommodation space in the Middle Jurassic–Lower Cretaceous on the eastern Russian Plate

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Abstract

This study presents new data on transgressive–regressive and accommodation–sedimentation regimes in the eastern Russian Plate during the Middle Jurassic–Lower Cretaceous. The proposed generalized scheme illustrating the combined effects of three major factors (eustasy, tectonic "noise", and depositional gradient) controlling the deposition of sequences with different stratal architecture allowed us to quantify the parameters of sedimentation (δS) and accommodation (δA) for second- and third-order cycles. A distinctive feature of the evolution of the Middle Jurassic–Lower Cretaceous sedimentary basin is the excess of accommodation space over sediment supply, which was not conducive to creation of clinoforms. The difference between stacking patterns in individual time intervals and the estimated values of $\delta A/\delta S$ may be indicative of the presence of unidentified stratigraphic breaks in the Bathonian and Late Tithonian–Berriasian, which were accompanied by erosion and reworking of sand strata. The stepwise regressive-transgressive deepening during the Oxfordian–Early Tithonian and transgressive–regressive shallowing during the Late Tithonian–Berriasian were probably caused by short-term manifestations of local tectonic "noise", and depositional hiatuses accompanied by the erosion of missing elements in the structure of third-order cycles. The Lower Cretaceous succession exhibits no mismatch between transgressive–regressive and retrogradational–progradational cycling, which provides another supporting evidence for a quiet tectonoeustatic and sedimentation regime during the Early Cretaceous compared to that of Middle–Late Jurassic time.

Keywords: accommodation; sedimentation; eustasy; tectonic noise; transgressive–regressive cycles; Middle Jurassic–Lower Cretaceous; second- and third-order cycles

Introduction

Middle Jurassic–Lower Cretaceous sediments have a widespread distribution in the eastern Russian Plate (ERP) (Fig. 1), where they have been the focus of lithostratigraphic, paleontological and mineralogical studies for over many years because they contain such a wide variety of mineral resources.

In the unified stratigraphic charts (Chirva, 1993; Yakovleva, 1993), they are subdivided into a succession of formations and sequences, which were identified within each structural zone and subzone on the basis of lithological and biostratigraphic criteria. The composite sections of each zone were correlated to a succession of regional biostratigraphic units and subdivisions of the General Stratigraphic Scale.

The revised standard zonation schemes of the Boreal Jurassic and Lower Cretaceous published in the early 2000s (Baraboshkin, 2004; Zakharov et al., 2005) provide a robust tool for tying Jurassic and Lower Cretaceous sediments within the ERP to the geological time scale (Gradstein et al., 2004) and thus can be used to establish a chronostratigraphic framework for the sedimentary basin that is essential for further reconstructions (Zorina, 2008, 2009, 2012b). The chronostratigraphic chart was constructed from unified cross-sections and added with a detailed sequence stratigraphy of the Jurassic and Lower Cretaceous sections in the northeastern Ulyanovsk–Saratov trough (UST) (Didenko and Zorina, 2003a,b).

The chronostratigraphic subdivision of Middle Jurassic–Lower Cretaceous rocks permitted recognition of the alternation between depositional and nondepositional episodes in the history of the basin. Tectonic and eustatic cycles were reconstructed on the basis of a lithologic and bathymetric profile as well as regional eustatic sea-level curves and curve of relative epeirogenic oscillations constructed from it (Zorina, 2012a,b).

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